CHAPTER 1

INTRODUCTION

The introductory chapter gives the outline about the simulation of the supersonic jet length for KT Oxygen Lance with 22mm diameter and 2:1 ratio of NG: O2 at electric arc furnace, the objectives and its contribution. The objectives give a clear definition to the focus of the improvement of electric arc furnace KT's system efficiency i.e. towards maximum utilization of oxygen as a chemical energy potential; an overview of the thesis layout of this research was also given.

1.1 MOTIVATION/ PROBLEM STATEMENT

Steel, iron ore from earth, nowadays probably has the widest range of applications of any material in this world. The wide range of alloy compositions, mechanical properties and product forms available make it versatile material that is used in components and products that may be small or large, high-tech or low tech, everyday or specialist. The original methods of producing steel were labor-intensive and highly skilled arts involving open crucibles. Steelmaking is the second step in producing steel from iron ore. In this stage, impurities such as sulfur, phosphorus and excess carbon are removed from the ore iron, and alloying elements such as manganese, nickel, chromium and vanadium are added to produce the exact steel required.

Currently, the steel industry is comprised of electric arc furnace (EAF) and integrated steel procedures. Many modern electric arc furnaces are equipped with variety of features to increase production rates, reduce heat times, and lower operating cost. One of the features was including oxygen injection by lances.

Oxygen is injected by lances in order to cut the solid scrap, for decarburization of metal liquid, to generate foaming slag by combustion of coal and for combustion of coal additives. Energy saving due to oxygen lancing arise from exothermic reactions (oxidation of carbon and iron) and because of the stirring from the bath which leads to temperature and composition homogeneity of the bath.

Nowadays, the present challenge is to determine the effective length compute from effective burning in the EAF from the combustion process happened and to maintain the supersonic velocity and coherency of oxygen jet good enough to allow penetration into the molten bath. Furthermore, the fundamental problem faced by the industry is to test case design before implementation for the operation in large scale (industry area). Normally, results from the experiment analysis nothing much help in solving problem faced in the industry exactly.

1.2 OBJECTIVES

The aim of this research/project is to determine the length of oxygen coherent jet for EAF's KT system by using Computational Fluid Dynamic (CFD) simulation software and validate with the result from PERWAJA STEEL SDN BHD. This is a collaboration project between Perwaja Steel and University Malaysia Pahang. A focus will be establish on the study of the KT Oxygen lance diameter and oxygen and natural gas ratio as the manipulated parameters for the simulation of the supersonic jet length at electric arc furnace.

1.3 SCOPE OF RESEARCH WORK

The scope of this research is to do simulation of the supersonic jet length by using 22mm nozzle diameter and 2:1 ratio of natural gas (NG), methane on oxygen shroud with the other parameters like pressure and flow rate are held constant to determine the effective length achieve for effective burning in the EAF.

1.4 RESEARCH CONTRIBUTION

The main benefit of this research is modeling and simulation of the supersonic jet length using the FLUENT software, via inserting the parameter needed into the simulation process. This will efficiently work to help the industry (PERWAJA STEEL) to estimate the optimize value of the length achieve within the EAF. Eventually, it can reduce the cost of doing experiment in the industry and save money to carry out the imbursement for new experiment and project.